

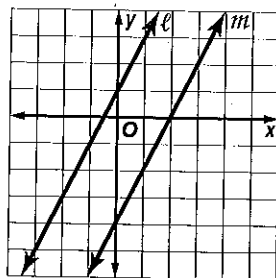
3-6

Study Guide and Intervention *(continued)***Perpendiculars and Distance**

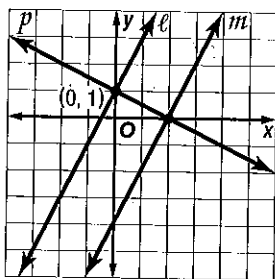
Distance Between Parallel Lines The distance between parallel lines is the length of a segment that has an endpoint on each line and is perpendicular to them. Parallel lines are everywhere **equidistant**, which means that all such perpendicular segments have the same length.

Example

Find the distance between the parallel lines ℓ and m whose equations are $y = 2x + 1$ and $y = 2x - 4$, respectively.



Draw a line p through $(0, 1)$ that is perpendicular to ℓ and m .



Line p has slope $-\frac{1}{2}$ and y -intercept 1. An equation of p is $y = -\frac{1}{2}x + 1$. The point of intersection for p and ℓ is $(0, 1)$.

To find the point of intersection of p and m , solve a system of equations.

$$\text{Line } m: y = 2x - 4$$

$$\text{Line } p: y = -\frac{1}{2}x + 1$$

Use substitution.

$$2x - 4 = -\frac{1}{2}x + 1$$

$$4x - 8 = -x + 2$$

$$5x = 10$$

$$x = 2$$

Substitute 2 for x to find the y -coordinate.

$$y = -\frac{1}{2}x + 1$$

$$= -\frac{1}{2}(2) + 1 = -1 + 1 = 0$$

The point of intersection of p and m is $(2, 0)$.

Use the Distance Formula to find the distance between $(0, 1)$ and $(2, 0)$.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(2 - 0)^2 + (0 - 1)^2}$$

$$= \sqrt{5}$$

The distance between ℓ and m is $\sqrt{5}$ units.

Exercises

Find the distance between each pair of parallel lines.

1. $y = 8$
 $y = -3$

2. $y = x + 3$
 $y = x - 1$

3. $y = -2x$
 $y = -2x - 5$